

REMARKS

Claims 14-25 are pending. The Applicant respectfully requests the Examiner to reconsider the rejections in view of amendments to the claims now presented and the following remarks.

Introduction

The Applicant respectfully wishes to begin by highlighting that none of the references cited by the Examiner teach a battery which employs a homogeneous microporous membrane which comprises engineering plastics and a hot melt adhesive as defined in the Applicant's written description and claims now presented. The references cited by the Examiner are indeed illustrative of problems in the industry that are in fact solved by the Applicant's invention. In summary, the performance of a battery depends mainly on the interface between the separator and the anode/cathode electrodes. For many years, researchers have worked diligently to develop a separator which could bind onto electrodes in order to build a good interface. The approach has been to apply an adhesive layer onto a porous substrate. Although the resulting separator does have the capability to bind to electrodes, the resulting battery has poor performance because pores of the separator become obstructed (clogged) by adhesive due to the penetration of the adhesive into pores when an adhesive solution is applied by coating, impregnating or spraying. To simplify the issues as much as possible for the Examiner, in order to expedite prosecution, the Applicant respectfully points out that this is true for each of the references cited by the Examiner. The most closely related reference to the subject matter of the claims now presented, Radovanovic '954, does not teach a homogeneous microporous membrane which comprises engineering plastics and a hot melt adhesive as defined in the Applicant's written description and claims now presented. The homogeneous microporous membrane of the present invention moreover has better wettability with polar electrolyte, lower surface resistance and higher ionic conductivity than anything previously described. Further, since the microporous membrane can be bound onto electrodes by heat activation without the addition of an adhesive, the resulting batteries of the present invention exemplify unparalleled interface between the separator and

electrodes. Accordingly, batteries of the present invention have showed better high-rate (discharge) capability, longer cycle life, in particular, low and stable impedance during hundreds of charge/discharge cycles, and much improved safety features.

Anticipation under 35 USC §102 requires a single prior art reference to disclose each and every limitation of the claimed invention.¹

I. Rejections under 35 USC §102

A. The Examiner's position at this time is that the subject matter of claim 14 is anticipated by the disclosure of Tanaka '645 as well as the disclosure of JP '161.

The Tanaka '645 disclosure is limited to a fabric-reinforced *composite* of a substrate and cross-linked polyvinyl alcohol (PVA). In contrast, batteries of the present invention particularly comprise a *homogeneous* microporous membrane comprising a hot-melt adhesive and an engineering plastics (as set forth in claim 14 presented herewith).

The JP'161 disclosure describes a separator composed of an adhesive resin layer coated on the surface of a sheet.² Accordingly, the JP'161 separator, *inter alia*, is not a homogeneous material.

Since neither Tanaka'645 or JP'161 teach the limitations of the Applicant's invention now claimed, the subject matter of the invention cannot be anticipated by these references as a matter of law. Accordingly, the Examiner is respectfully requested to withdraw the rejections.

B. The subject matter of claims 14 and 17-20 is alleged to be anticipated by the disclosure of EP '617.

EP'617 discloses a non-homogeneous separator *assembly* for batteries comprising two layers, i.e., a porous support layer, e.g., CELGARD®, bearing a layer of a non-woven fusible fabric. "The materials from which the separator assembly are made must also be a) insoluble in

¹ Schering Corp. v. Geneva Pharmaceuticals, Inc. (Fed. Cir. August 1, 2003) citing Lewmar Marine, Inc. v. Barient, Inc., 827 F.2d 744, 747 (Fed. Cir. 1987).

² Having an electric resistance of 1×10^{-2} OMEGA/dm² or less formed by an electric-insulating adhesive which becomes fluidic at below 120°C.

the selected electrolyte, [and] b) electrically insulating". EP'617, Page 2, line 31, *et seq.* In sharp contrast, however, the instant claims require a homogeneous microporous membrane of the battery to comprise an engineering plastics. Since this is not within the teachings of the EP'617 disclosure, the Applicant's claimed invention cannot be anticipated, *per se*, as a matter of law. Accordingly, the Applicant respectfully requests the Examiner to withdraw the rejection.

C. The subject matter of claims 14 and 16-20 is alleged to be anticipated by the disclosure of Radovanovic '954.

The '954 disclosure is drawn toward a microporous material containing a polymer mixture containing a first polymer component having a melting point greater than 140°C and a second polymer component having a melting point lower than 120°C., wherein the first polymer component and the second polymer component are miscible in a compound or compatible liquid when heated above the melting temperature of the first polymer component or the liquid-liquid phase separation temperature and phase separate from the compound or compatible liquid when cooled, and wherein the microporous material becomes substantially impervious to fluid flow or electric current flow when heated above the melting point of the second polymer component and retains film-like properties. Polymers disclosed, however, are melt-processible in contrast to the hot melt adhesive required by the instant claims.³ Moreover, the '954 disclosure does not teach the use of an engineering plastics. In sharp contrast, the Applicant's described batteries comprise a homogeneous microporous membrane comprising a hot-melt adhesive and an engineering plastics. Accordingly, the Applicant respectfully requests the Examiner to withdraw the rejection.

D. The subject matter of claims 14 and 17-20 is alleged to be anticipated by the disclosure of EP '796.

The '796 disclosure is drawn toward manufacture of a lithium ion secondary battery in which a positive electrode, and a separator can be stuck fast to one another without using a solid

³ The '954 microporous material, for example, cannot bind to battery electrodes. The '954 preferred polymers, for example, are olefinic. '954, col.4, lines 36-37.

casing and without increasing the resistance between electrodes. The adhesive resin forming the adhesive resin layer is material which is not dissolved in an electrolyte and becomes a porous film without causing an electrochemical reaction inside the battery. Examples provided are a fluororesin, a mixture containing a fluororesin as a main component, and poly(vinyl alcohol). Examples of the fluororesin are a homopolymer or a copolymer having a fluorine atom in its molecular structure such as vinylidene fluoride and ethylene tetrafluoride, a polymer or a copolymer having vinyl alcohol in the molecular structure, or a mixture of poly(methyl methacrylate), polystyrene, polyethylene, polypropylene, poly(vinylidene chloride), poly(vinyl chloride), polyacrylonitrile, or poly(ethylene oxide). Among those, poly(vinylidene fluoride) of a fluororesin is appropriate. '796 ¶ 27.

The '796 description, i.e., the application of an adhesive resin on a separator layer is in sharp contrast to the subject matter of the Applicant's claims now presented, i.e., a battery comprising a *homogeneous* microporous membrane comprising a hot-melt adhesive and an engineering plastics. Since the subject matter of the claims now presented is not within the scope of the EP'796 disclosure, the Applicant's claimed invention cannot be anticipated, *per se*, as a matter of law. Accordingly, the Applicant respectfully requests the Examiner to withdraw the rejection.

II. Rejections under 35 USC §103

A. The Examiner's position at this time is that the subject matter of claim 15 is obvious over any one of Radovanovic '954, EP '617, or EP '796; in view of the disclosure of Adachi '317.

The Applicant respectfully submits that the combination of references cited by the Examiner cannot, as a matter of law, render the invention defined by the claims now presented obvious under 35 USC §103 because the prior art reference (or references when combined) must teach or suggest all the claim limitations.

Adachi discloses a solid electrolyte (rather than a membrane) comprising solid electrolyte powder and insulating elastomer only.

It is axiomatic that a claimed invention is not obvious solely because it is composed of

elements that are all individually found in the prior art. In re Rouffet, 149 F.3d 1350, 1357, 47 USPQ2d 1453, 1457 (Fed. Cir. 1998). Since none of the references discussed *supra*, either independently or when combined, solve the problems in the art outlined herein -or- teach the subject matter now claimed, i.e., a battery comprising a homogeneous microporous membrane comprising a hot-melt adhesive and an engineering plastics, wherein the microporous membrane comprises a tackifier, in an amount up to about 50% by weight, selected from the group consisting of a hydrocarbon resin and poly(vinylidene fluoride-hexafluoropropene) cannot be obvious as a matter of law. Accordingly, the Applicant respectfully requests the Examiner to withdraw the rejection in view of the scope of the claims now presented.

Double Patenting Rejection

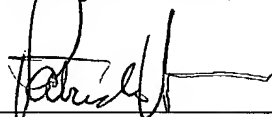
The Applicant diligently presents herewith a terminal disclaimer under 37 CFR §1.321(c) which refers to the term of U.S. Patent No. 6,527,955, per the Examiner's request.

* * *

For all the foregoing reasons, the Applicant submits that claims 14-25 are in condition for allowance. Early action toward this end is courteously solicited. *The Examiner is kindly encouraged to telephone the undersigned in order to expedite any detail of the prosecution.*

The Commissioner is authorized to charge any deficiency or credit any overpayment in connection herewith to Deposit Account No. 13-2165.

Respectfully submitted,



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